

CLAIMS

What is claimed is:

1. A method of analyzing structural characteristics of sidewall spacers fabricated on a wafer, comprising the steps of:
  - etching said sidewall spacers on said wafer using an etcher;
  - providing a grating bar having a plurality of grating targets each comprising a gate electrode and a pair of dielectric spacers;
  - generating a theoretical optical scatterometry spectrum by subjecting said grating targets to input light in optical scatterometry;
  - generating an experimental optical scatterometry spectrum by subjecting said sidewall spacers to input light in optical scatterometry;
  - comparing said experimental optical scatterometry spectrum to said theoretical optical scatterometry spectrum; and
  - equating said structural characteristics of said sidewall spacers with said structural characteristics of said grating targets when said theoretical optical scatterometry spectrum substantially matches said experimental optical scatterometry spectrum.

2. The method of claim 1 further comprising the steps of providing an SPC chart having said experimental optical scatterometry spectrum and said theoretical optical scatterometry spectrum, providing control limits for said SPC chart and activating an alarm when said experimental optical scatterometry spectrum strays beyond said control limit.

3. The method of claim 1 further comprising the step of cleaning said wafer in a wet-clean process after said etching the sidewall spacers on said wafer.

4. The method of claim 1 wherein said dielectric spacer is a single-layer dielectric spacer or a multi-layer dielectric spacer.

5. The method of claim 1 wherein said dielectric material is a material selected from the group consisting of an oxide, a nitride, an oxynitride, silicon carbide, and any combination of an oxide, a nitride, an oxynitride and silicon carbide.

6. The method of claim 1 further comprising a spectroscopic ellipsometer system for carrying out said optical scatterometry and a computer connected to said system, and wherein said theoretical optical scatterometry spectrum is generated simultaneously with said experimental optical scatterometry spectrum in a real-time mode.

7. A method of analyzing structural characteristics of sidewall spacers fabricated on a wafer, comprising the steps of:

etching said sidewall spacers on said wafer using an etcher;

providing a grating bar having a plurality of grating targets each comprising a gate electrode and a pair of dielectric spacers each selected from the group consisting of a single-layer offset spacer, an L-shaped spacer, a triangular-shaped spacer and a trapezoid-shaped spacer;

generating a theoretical optical scatterometry spectrum by subjecting said grating targets to input light in optical scatterometry;

generating an experimental optical scatterometry spectrum by subjecting said sidewall spacers to input light in optical scatterometry;

comparing said experimental optical scatterometry spectrum to said theoretical optical scatterometry spectrum; and equating said structural characteristics of said sidewall spacers with said structural characteristics of said grating targets when said theoretical optical scatterometry spectrum substantially matches said experimental optical scatterometry spectrum.

8. The method of claim 7 wherein said single-layer offset spacer is up to about 1,000 angstroms.

9. The method of claim 7 wherein said dielectric spacers are absent from a top portion of said gate electrode.

10. The method of claim 1 further comprising the step of indicating a portion of said structural characteristics of said sidewall spacers as a readout parameter and wherein said readout parameter comprises a width of said sidewall spacers.

11. The method of claim 9 wherein said readout parameter further comprises a top loss of said sidewall spacers.

12. The method of claim 1 further comprising a spectroscopic ellipsometer system for carrying out said optical scatterometry and a computer connected to said system, and wherein said theoretical optical scatterometry spectrum and said structural characteristics of said grating targets are stored as a library in said computer.

13. The method of claim 1 further comprising the step of obtaining theoretical optical scatterometry spectra by generating computer simulations of said structural characteristics of said grating targets.

14. The method of claim 1 further comprising a spectroscopic ellipsometer system for carrying out said optical scatterometry and wherein said spectroscopic ellipsometer system is installed in said etcher.

15. The method of claim 1 wherein said input light comprises wavelength of from about 200 nm to about 900 nm.

16. The method of claim 1 wherein said input light is polarized.

17. The method of claim 2 wherein said optical scatterometry utilizes two spectra of said input light.

18. The method of claim 1 wherein said plurality of grating targets define a grating area of at least about  $20 \mu\text{m}^2$ .

19. The method of claim 1 further comprising establishing a judgment parameter for said comparing said experimental optical scatterometry spectrum to said theoretical optical scatterometry spectrum, wherein 0 is no homology and 1 is complete homology.

20. The method of claim 1 grating bar comprises a silicon bar substrate and wherein said grating targets are provided on said grating bar.

21. The method of claim 1 further comprising the step of indicating a portion of said structural characteristics of said sidewall spacers as a readout parameter and wherein said readout parameter comprises a spacing between said sidewall spacers.

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22. A method of analyzing structural characteristics of sidewall spacers fabricated on a wafer, comprising the steps of:

    etching said sidewall spacers on said wafer using an etcher;

    providing a grating bar having a plurality of grating targets each comprising a gate electrode and a pair of dielectric spacers flanging said gate electrode and absent from a top portion of said gate electrode;

    generating a theoretical optical scatterometry spectrum by subjecting said grating targets to input light in optical scatterometry;

    generating an experimental optical scatterometry spectrum by subjecting said sidewall spacers to input light in optical scatterometry;

    comparing said experimental optical scatterometry spectrum to said theoretical optical scatterometry spectrum;

    equating said structural characteristics of said sidewall spacers with said structural characteristics of said grating targets when said theoretical optical scatterometry spectrum substantially matches said experimental optical scatterometry spectrum; and

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indicating a portion of said structural characteristics of said sidewall spacers as a readout parameter and wherein said readout parameter comprises a spacer top loss range of said sidewall spacers across said wafer.